

Appendix F

Sample Operation and Maintenance Manual

F-1. General

a. Purpose. This appendix provides the format for an Operation and Maintenance (O&M) manual for a typical stormwater pump station. The O&M manual is prepared for a pump station at the time the station has been completed including all pump testing.

b. Procedure. This appendix is divided into two major sections. The first is the example presentation of the table of contents for a pump station O&M manual. This indicates the topics which are normally covered by a manual of this type. The second is a presentation of the charts and instructions usually provided in a manual of this type. These include an operating log, annual inspection report, maintenance chart, operating sequence diagram, and operating instructions.

OPERATION AND MAINTENANCE MANUAL
BLUE WATERS DITCH PUMPING STATION

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BLUE WATERS DITCH PUMPING STATION PUMP STATION OPERATING LOG				
River Stage Reading: _____		Date: _____		
Operator: _____				
Storm Water Pump Unit No.	No. 1	No. 2	No. 3	Remarks
Float Dial Reading or Staff Gage Reading				
Motor Start Time				
Motor Stop Time				
Time of Reading				
Air Receiver Pressure				
Discharge Staff Gage Reading				
Motor Readings				
Voltage				
Amps				
Elapsed Hours				

BLUE WATERS DITCH PUMPING STATION ANNUAL INSPECTION REPORT

DATE: _____

MECHANICAL:	GENERAL CONDITION OF EQUIPMENT				
	STORM WATER PUMPS			SUMP PUMP	REMARKS
	No. 1	No. 2	No. 3		
1. Pump					
Bearings					
2. Farval Lubricators					
3. Roller Gates					
Gate Operator (Manual)					
Gate Operator (Motor)					
Stems					
4. Crane and Hoist					
5. Siphon Breakers					
6. Trashracks					
7. Trash Rakes					
Drive Chain					
Bearings					
Gear Reducers					
ELECTRICAL:					
1. Motors					
2. Motor Bearings					
3. Switchgear Controls					
4. Control Panels					
GENERAL:					
1. Water Levels	Elevation		Remarks		
Forebay					
Sumps					

Building and Grounds:					DATE: _____	
1. Sump						
2. Forebay						
3. Discharge Chamber						
4. Gatewell to River Outlet						
5. Structure						
6. Fire Extinguishers						
7. Tools and Cabinets						
8. Painting						
9. Caulking						
10. Grating, Rails and Ladders						
11. Water System and Plumbing						
12. Louvers and Ventilators						
13. Windows						
14. Doors						
Remarks: _____						
Mechanical Vibration Levels:		STORM WATER PUMPS			SUMP PUMP	REMARKS
		No. 1	No. 2	No. 3		
North-South	Upr					
	Lwr					
East-West	Upr					
	Lwr					
Axial:						
Motor						
Floor						
Coast Down Time						
Electrical Insulation Resistance Readings:						ROLLER GATES
T1						
T2						
T3						
Temp. in Degrees C						
SIGNATURE: _____						

BLUE WATERS DITCH PUMPING STATION MAINTENANCE CHART

[illegible]

NOTE: FOR LEGEND AND NOTES SEE SHEET A-12

	START-UP	MONTHLY	3-MO	6-MO	1 YR	5 YR	OPR HRS
TRASH RAKE		GI, O, CL			GI (8)		
MOTORS				AL (8)	PG (8)	CL	
HEATERS	GI						
GEAR REDUCER		GI		CH (10)			
DRIVE CHAIN	PG-8						PG-8
PILLOW BLOCKS				PG (8)			
TORQUE LIMIT COUPLING					PG (8)		
SHEAR PIN & SPROCKET		GI					
TRIP CAM		GI			GI, CL		
CONTROL PANEL							
SUBSTATION DRAINAGE					GI		
BUILDING STRUCTURE			GI				
TRASHRACK				GI			
TOILET FACILITY				GI			
DOMESTIC WATER				GI			
HOLDING TANK			GI		PO		
SIPHON BREAKERS			GI				
UNIT HEATERS					GI		
FIRE EXTINGUISHERS		GI		GI			
SWITCHGEAR	GI						
BUS AND CONNECTIONS					GI, CL		
INSTRUMENTS AND LAMPS	GI				GI, CL		
HEATERS					GI		
LIGHTING PANEL	GI				GI		
CONTROL PANELS	GI				GI		
GROUNDING					GRT		
FLOAT CONTROL	GI				GI		
MAIN PUMP MOTOR STARTS		TS					
ENTRANCE CHANNEL							
SUMP					GI, RS	GI, RS	

NOTES:
 1. TIME PERIOD OR HOURS, WHICHEVER COMES FIRST
 2. 5 TO 10% ACIDLESS TALLOW WITH VISCOSITY OF 150 SSV @ 210 F
 3. TURBINE OIL ISO VG68 (APPROX. 30 GAL.)
 4. SCRAPE OUT OLD GREASE AND ADD 19.5 OZ. LITHIUM BASE GREASE (NLGI #2)
 5. 150 SSV NON-DETERGENT NAPHTHENE-BASE OIL WITH RUST AND OXIDATION INHIBITORS
 6. ANSI B30.16
 7. SEE HOIST O&M MANUAL FOR LUBRICATION TYPE
 8. SAE 10
 9. NLGI #2
 10. AMGA #4

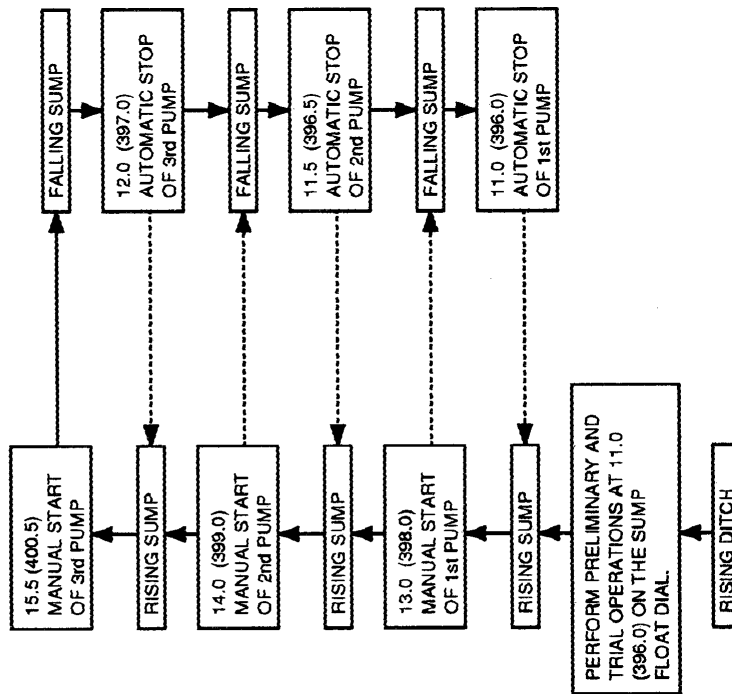
LEGEND:
 O OPERATE
 CH CHANGE
 CL CLEAN
 MR MEGGER AND RECORD
 PG PRESSURE GREASE
 SG SURFACE GREASE
 RC REMOVE CONDENSATE
 GI GENERAL INSPECTION
 GRT GROUND RESISTANCE TEST
 TO TEST OIL
 AL ADD LUBRICANT
 PO PUMP OUT
 TS TEST (SEE A-19 FOR PROCEDURE)
 RS REMOVE SILT

Blue Waters Ditch Pumping Station
Appendix A

BLUE WATERS DITCH PUMPING STATION

GENERAL

The Pump Station shall be made ready for operation by performing the preliminary and trial operations described by a competent operator when there is a rising sump and an interior water level of 396.0. The pump station shall be put into flood stage operation at a water elevation of 398.0 on the interior water level gage.



NOTES:

1. The Zero on the float dial is Elev. 385.0 feet N.G.V.D. which is sump floor elevation.
2. The float dial switch contacts are set the same for all pumps for permissive start and as shown on the chart for Elev. 396.0.
3. The operation of the Blue Waters Ditch Gravity Drain is by the Metro-East-Sanitary District. The pump station operator should coordinate with the sanitary district before operating the pumping station to insure the drain is closed.

BLUE WATERS DITCH PUMPING STATION
INTERIM OPERATING INSTRUCTION

GENERAL

THE PUMP STATION SHALL BE MADE READY FOR OPERATION BY PERFORMING THE PRELIMINARY AND TRIAL OPERATIONS SHOWN BELOW WITH A COMPETENT OPERATOR WHEN THE INTERIOR WATER LEVEL REACHES 396.0 FEET OR 11.0 FEET ON THE FLOAT DIAL. THE PUMP STATION SHALL BE PUT INTO FLOOD STAGE OPERATION AT 398.0 FEET ON THE LANDSIDE GAGE OR 13.0 FEET ON THE FLOAT DIAL.

PRELIMINARY

1. OPENING STATION

- A. TURN ON LIGHT INSIDE THE STATION.
- B. TURN MAIN CIRCUIT BREAKER CONTROL TO "CLOSE" POSITION. (RED "BREAKER CLOSED" INDICATING LIGHT ON)
- C. MAKE CHECK OF THE PHASE-TO PHASE USING THE "VOLTMETER" SWITCH TO SELECT PAIRS OF PHASE.

NOTE: THE VOLTAGE MUST BE BETWEEN 3700 AND 4500 VOLTS FOR EACH PHASE WITH NOT GREATER THAN 200V DIFFERENCE PHASE TO PHASE. IF THE VOLTAGE IS OUTSIDE THIS RANGE, THE UNION ELECTRIC COMPANY MUST BE NOTIFIED IMMEDIATELY. NO PUMP OPERATION WILL BE ALLOWED WITH THE VOLTAGE OUTSIDE THIS RANGE

- D. TURN ON ALL POWER PANEL BOARD CIRCUITS. (NO. 1-17 ON SWITCH GEAR)
- E. REMOVE THE THREE INTAKE LOUVER COVERS.
- F. START THE TWO POWER ROOF VENTILATORS BY TURNING THE SWITCHES TO THE "HAND" POSITION.
- G. CHECK THAT THE THREE MOTOR OPERATED INTAKE LOUVERS ARE OPEN.

2. AIR SYSTEM

- A. START ELECTRIC DRIVEN AIR COMPRESSOR SYSTEM.
 - (1) SET DISCONNECT SWITCH TO "ON" POSITION.
 - (2) PRESS "RESET" PUSH-BUTTON.
 - (3) TURN SELECTOR SWITCH TO "AUTO". (RED INDICATING LIGHT ON.)
- B. CHECK THAT THE AIR COMPRESSOR STARTS IF THE AIR RECEIVER PRESSURE IS LESS THAN 120 PSI AND THAT IT STOPS WHEN THE PRESSURE REACHES 150 PSI.
- C. OPEN AND CLOSE THE DRAIN VALVES ON THE BOTTOM OF THE AIR RECEIVER, STRAINER, AND FILTER TO DRAIN ANY CONDENSATION.

3. CONDITION OF DITCH APPROACH AND TRASHRACK.

- A. CHECK FOR ICE OR OTHER DEBRIS.
- B. LUBRICATE THE LINKS OF TRASH RAKE DRIVE CHAIN USING THE AIR OPERATED PORTABLE GREASE PUMP.
- C. REMOVE TRASH FROM THE TRASH RACK.
 - (1) SET DISCONNECT SWITCH TO "ON" POSITION.

NOTE: ALARM SIREN WILL SOUND.

- (2) PRESS THE "RESET" PUSH-BUTTON.
- (3) PLACE SELECTOR SWITCH TO "FWD" POSITION.
- (4) PRESS THE "FORWARD START" PUSH-BUTTON.
- (5) REMOVE DEBRIS.
- (6) PRESS THE "STOP" PUSH-BUTTON.

NOTE: ABOVE PROCEDURE SHALL BE REPEATED FOR ALL THREE TRASH RACKS.

4. OPEN ALL OF THE SUMP ROLLER GATES.

- A. SET DISCONNECT SWITCH TO "ON" POSITION.
- B. USE ELECTRIC OPERATOR TO FULLY OPEN THE GATE BY PRESSING THE "OPEN" BUTTON (GREEN INDICATOR LIGHTS ON AT FULL OPEN POSITION)
- C. IF GATE DOES NOT OPEN ENGAGE MANUAL LEVER AND OPERATE HANDWHEEL IN THE "OPEN" DIRECTION.

NOTE: ABOVE PROCEDURE SHALL BE REPEATED FOR ALL THREE ROLLER GATES.

5. PUMP LUBRICATION

- A. CHECK THAT THE LEVEL OF GREASE IN THE FARVAL LUBRICATOR RESERVOIR IS ADEQUATE
- B. TURN LUBRICATOR CONTROL SWITCH (LOCATED ON THE OUTSIDE OF THE FARVAL CONTROL ENCLOSURE) TO "MANUAL" POSITION AND PRESS THE "MANUAL" PUSH-BUTTON TWO TIMES, FOR PRE-GREASING CYCLE.
- C. TURN FARVAL LUBRICATOR CONTROL SWITCH TO THE "AUTO" POSITION.

6. ELECTRIC MOTOR LUBRICATION

- A. CHECK THAT THE LUBRICATING OIL IN THE UPPER CHAMBER IS AT THE PROPER LEVEL BY CHECKING THE SIGHT GLASS TO SEE THAT THE OIL LEVEL IS BETWEEN THE MINIMUM AND THE MAXIMUM.
- B. CHECK THAT LUBRICANT IS PRESENT IN THE LOWER MOTOR BEARING BY OPENING THE "GREASE OUTLET" PLATE ON THE SIDE OF THE MOTOR.

7. ROTATE PUMPS MANUALLY ONE FULL REVOLUTION TO ASSURE FREE ROTATION.

8. CHECK FLOAT SWITCH SETTINGS ACCORDING TO OPERATING SEQUENCE DIAGRAM.

9. SIPHON BREAKER VAULT (LOCATED AT TOP OF LEVEE).

- A. CHECK THAT WIRE CLOTH PIPE COVER IS UNBROKEN.
- B. CHECK THAT AIR-OPERATED BUTTERFLY VALVE IS IN "OPEN" POSITION.
- C. CHECK THAT EACH OF THE THREE MANUAL ACTUATED BUTTERFLY VALVES IS IN THE "CLOSED" POSITION.

THE PUMP STATION SHALL BE MADE READY FOR OPERATION BY PERFORMING THE PRELIMINARY

TRIAL OPERATION

1. PUMP START (WATER LEVEL IN SUMP MUST BE ELEV. 396.0 OR HIGHER - 11.0 ON THE FLOAT DIAL)

A. LIGHTING PANEL.

(1) TURN 'OFF' YASKAWA MOTOR WINDING HEATERS (*17, *19, *21)

CIRCUIT BREAKERS BEFORE STARTING MOTORS.

B. ELECTRIC MOTORS

(1) TO TEST MOTOR STARTER WITHOUT ENERGIZING MOTORS:

A) BE SURE THAT THE PUMP MOTOR CONTACTOR BEING TESTED IS DRAWN OUT BY CHECKING THAT THE MOTOR LOAD BREAK SWITCH OPERATING HANDLE IS IN THE FULLY DOWN POSITION. TURN THE 'TEST - NORMAL' TWO-POSITION SELECTOR SWITCH TO THE 'TEST' POSITION. THE GREEN 'OFF' PILOT LIGHT WILL ILLUMINATE, INDICATING THAT CONTROL POWER IS ON.

B) TEST THE 3 - PHASE 4160 VAC CONTACTOR BY DEPRESSING THE 'TEST' PUSHBUTTON.

C) WITH THE 'TEST' PUSHBUTTON DEPRESSSED, DEPRESS THE BLACK 'START' PUSHBUTTON. THE 3 - PHASE 4160 VAC CONTACTOR SHALL BE HEARD TO BANG SHUT, SIMULTANEOUSLY ILLUMINATING THE RED 'RUN' PILOT LIGHT AND EXTINGUISHING THE GREEN 'OFF' PILOT LIGHT.

D) IF THIS DOES NOT HAPPEN, CALL A CERTIFIED ELECTRICIAN TO CHECK THE SWITCHGEAR.

E) IF THE TEST IS SUCCESSFUL, DEPRESS THE RED 'STOP' PUSHBUTTON. THE CONTACTOR SHOULD BANG OPEN. SIMULTANEOUSLY THE GREEN 'OFF' PILOT LIGHT SHOULD ILLUMINATE AND THE RED 'RUN' PILOT LIGHT SHOULD EXTINGUISH

F) RETURN THE 'TEST - NORMAL' TWO-POSITION SELECTOR SWITCH TO THE 'NORMAL' POSITION.

(2) RAISE MOTOR LOAD BREAK SWITCH TO 'ON' POSITION FOR PUMP NO. 1 AND THREAD THE CAPTIVE THUMB SCREW INTO PLACE USING FINGER PRESSURE ONLY TO TIGHTEN. (GREEN 'OFF' INDICATING LIGHT ON) NOTE TIME.

WARNING: DO NOT OPERATE PUMPS WHEN WATER LEVEL IN SUMP IS BETWEEN ELEV. 396.0 AND ONE FOOT BELOW THE PUMP SUCTION.

(3) AFTER WAITING FIVE MINUTES PLACE THE 'SIPHON MODE' SWITCH IN THE 'OFF' POSITION.

(4) TURN THE START SELECTOR SWITCH TO THE 'ON' POSITION.

(5) DEPRESS AND HOLD DOWN THE 'TEST' PUSH-BUTTON AND THEN PRESS THE 'START' PUSH-BUTTON ('RUN' LIGHT ON).

(6) AFTER MOTOR HAS OPERATED FOR APPROXIMATELY 10 SECONDS RELEASE THE 'TEST' PUSH-BUTTON ('OFF' LIGHT ON). IF THE FLOAT DIAL IS BELOW THE CUTOFF ELEVATION FOR THE PUMP THE UNIT WILL SHUTDOWN. IF THE UNIT DOES NOT STOP THEN DEPRESS THE 'STOP' PUSH-BUTTON.

(7) TURN FARVAL LUBRICATOR SWITCH TO 'OFF' POSITION.

NOTE: REPEAT ABOVE PROCEDURE FOR PUMPS NO 2 AND 3.

PUMPING OPERATION DURING FLOOD STAGE

1. WET TEST PUMPING SYSTEM IF SUMP WATER LEVEL IS AT FLOAT DIAL READING 11.0 FT. (ELEV. 396.0 N.G.V.D.). PERFORM IDENTICAL OPERATIONS AS DONE IN DRY TEST.

2. TURN THE FARVAL LUBRICATOR SELECTOR SWITCH TO THE 'AUTO' POSITION.

3. REPEAT 'TRIAL OPERATION' NO 1B.

4. PUMPING OPERATION.

A. OPEN SIPHON BREAKER AIR SUPPLY VALVE LOCATED IN THE SOUTHWEST CORNER OF BUILDING.

B. PLACE THE FARVAL LUBRICATOR CONTROL SWITCHES IN THE 'AUTO' POSITION.

C. FOLLOW THE OPERATING SEQUENCE DIAGRAM.

D. MANUALLY START PUMPS AT SPECIFIED LEVELS.

(1) START PUMP FOLLOWING THE SAME PROCEDURE USED IN WET TEST EXCEPT PLACE THE 'SIPHON MODE' SELECTOR SWITCH IN THE 'AUTO' POSITION AND PRESS THE 'START' PUSH-BUTTON ONLY (RED 'RUN' INDICATING LIGHT ON) TO START EACH PUMPING UNIT.

NOTE: A TIMER IN THE SWITCHGEAR WILL PREVENT THE RESTART OF ANY UNIT UNTIL 5 MINUTES AFTER SHUTDOWN (TO PREVENT RESTART OF MOTOR WITH THE PUMP BACK SPINNING).

E. DURING PUMPING OPERATIONS, AT 15 MINUTE MAXIMUM INTERVALS OBSERVE THE RUNNING CONDITION OF THE EQUIPMENT.

(1) CHECK THE VOLTMETER ON THE SWITCHGEAR AND THE AMMETERS ON THE CONTROL PANELS OF EACH MOTOR STARTER.

(2) IF THE CURRENT EXCEEDS 150 AMPS THE MOTOR SHALL BE STOPPED AND THE CAUSE OF THE EXCESSIVE CURRENT CORRECTED.

(3) RECORD OPERATING DATA AT 30 MINUTE INTERVALS.

(CONTINUED ON B-4)

(Continued from B-3)

5. Lubrication During Pumping Operation.

- a. Check that the Farval unit lubricates the pump automatically every 20 minutes of operation by observing the counter every two hours.

(Red indicating light on through grease cycle).

6. Keep Trash Rack Clear of Debris.

- a. follow step 3b of the preliminary section as needed.

7. Keep log of All Operations.

- a. Record start and stop times.
- b. Record all abnormal noise, vibration and overheating.

8. As float control automatically shuts down pumping units, check that siphon breaker valve has opened. If it does not open, the operator must open it by manually operating the valves in the compressed air control panel as shown in appendix E of the O&M manual or must manually operate the lever actuated butterfly valve located in siphon breaker vault must be opened.

NOTE: Ear protection must be used when opening this valve.

CLOSING DOWN STATION

1. Loosen the captive thumb screw and lower motor load breaker switch to the "OFF" position. Padlock the switches.

2. Lubrication.

- a. Fill Farval lubricator reservoir with grease.
- b. Turn heater switch on Farval lubricator control panel to 50-watt position.
- c. Check that the lubricating oil in the electric motors is at the

proper level by checking the sight glass to see that the oil level is between the minimum and the maximum.

e. For cold weather:

- (1) Turn off water

- (2) Drain all pipes by opening drain valves in the sump

- (3) Add anti-freeze to sink trap, toilet trap and toilet flush tank and bowl.

d. Check that lubricant is present in the lower motor bearing by opening the "GREASE OUTLET" plate on the side of the motor.

3. Check Supplies and Clean Station.

- a. Inspect and clean all equipment.
- b. Restore tools to tool chests.
- c. Replenish supplies (oil, grease, etc.)
- d. Remove all fire hazards (oil rags, etc.)

4. De-energize Air System.

- a. Turn electric driven air compressor switch to "OFF"
- b. Drain air receiver.
- c. Set disconnect switch to the "OFF" position.

5. Turn off power roof ventilators and check that all motor operated dampers close.

- a. Replace the three intake louver covers.

6. Insure that all strip heater circuits in the lighting panel are turned on. Leave the three lubricator circuits on.

7. Dewater Sump.

- a. Close all the sump roller gates.

(1) Press the "CLOSE" push-button and wait until gate is completely closed.

(2) Set disconnect switch to the "OFF" position. Padlock the switches.

b. Turn on the sump pump and wait until the float switch in the dewatering man hole shuts off the pump. Clean the sump as required.

8. Set the disconnect switches on each trash rake to the "OFF" position. Padlock the switches.

9. Turn Main Circuit breaker to "TRIP" position. (Green "BREAKER OPEN" light on)

10. Turn off all power panel board circuits except #15.

11. Transfer to 240V 3 Phase auxiliary power circuit from Union Electric.

12. Turn off all lights.

13. Close station and lock doors.

REFER TO SHEET B1 FOR OPERATING SEQUENCE DIAGRAM.

NOTE: In case of a loss in the 240 volt service the following procedure will allow continued operation of the station.

a. Depress the "CLOSE" push-button on the "Transformer FEEDER". (Red indicating light on).

b. Transfer switch must be moved from the down position to the up position